

Nonlinear Dynamics and Chaos – Group Work

Professor:

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Dear Students of Applied Math,

My name is Bongo Bob Gato and I am the C.E.O of a small company that raises happy rabbits on a large farm. People throughout the USA buy our bunnies as pets, our bunnies are the fluffiest. The problem is that each year we need to take some of the population from our farm to sell, but we are not sure how many bunnies we should take. Some years we take too many, leaving too few to repopulate, and then have to buy more bunnies to start the next year. Other years we take too few, making the farm too crowded, and have to give the bunnies away. Ideally we would keep our population around 100 bunnies but again this varies widely, some years we can't afford to buy more and our population starts as low as 20 bunnies and other years we can't seem to find good homes for the bunnies and our population starts as high as 120.

We have had an engineer come study our problem, but she turned out to be a real creep. She took our money and left without giving us any information. The only thing we found in her office was a crumpled up piece of paper with the following written on it:

$$\frac{dP}{dt} = 2P(1 - P/100) - S, \quad P(0) = P_0$$

where t is time measured in weeks, but we don't know what this means. Our company is coming to you for help with this problem.

1. First of all, we would like to understand what this equation means.
2. Second, we would like understand what will happen to our bunny population, depending on how many bunnies we remove each year and how many bunnies we start with. We don't need you to decide how many bunnies should be removed or how many we should start with, we just want a full analysis of the population.
3. Ideally, you could get as much information from this equation as possible for all the different selling rates and starting populations, and summarize it for us.
4. Also, it would be helpful to have the information boiled down to just one or two graphs, so that it is easy to show to the other board members.

The group with the winning (nicest, neatest, most informative) graph gets a job with our company!

Thanks in advance for your help!

Bongo Bob Gato



C.E.O Bunnies R Us